



Improving Health Major Goal of LLNL Bioscience

Bioscience researchers at Lawrence Livermore National Laboratory (LLNL) are working to improve human health by understanding the structure and functions of DNA and proteins and by developing new tools and techniques for both the scientific and health care communities.

We are learning how subtle yet permanent alterations to DNA cause changes in proteins and other biological molecules, sometimes leading to cancer and other diseases. At the same time, we are among the leaders in understanding the role of DNA repair mechanisms and other processes that protect cells from radiation and other insults.

We are working to better understand the molecular and genetic basis of cancer and discover ways to detect and treat it more effectively and less expensively. Much of our work centers on the relationship between cancer and DNA and proteins because cancer is often caused by defective proteins or by molecules that bind to and alter DNA.

The research includes the mechanisms of anti-cancer drugs, DNA repair enzymes, and new tools for physicians and hospitals.

Decoding the Human Genome

We have an active role in the worldwide Human Genome Project, the largest biological undertaking in history. This project is locating all the genes on human DNA, determining their precise sequence, and learning their function. The ultimate goal is to develop a molecular-level understanding of how we develop from embryo to adult, what makes us work, and what causes things to go wrong.

We are active in the Department of Energy's Joint Genome Institute, a collaboration of Lawrence Livermore, Lawrence Berkeley, and Los Alamos

national laboratories. The work has focused on sequencing human chromosomes 5, 16, and 19. Chromosome 19 is home to the genes that govern lymphoid leukemia, myotonic dystrophy, diabetes mellitus and a susceptibility to polio.

Understanding Environmental Health Effects

For many years LLNL researchers have been studying the link between diet and cancer. In particular, they have looked at chemicals produced during the cooking of foods that may damage DNA. These compounds may be a risk factor associated with several cancers such as breast, prostate, colon and others. We are applying technologies as diverse as cytogenetics and molecular modeling on our supercomputers to measure DNA changes in rat tumors produced by the chemicals and to model the exact binding mechanisms between the chemicals and DNA.

Several other studies focus on DNA damage from other environmental insults, such as smoking. For example, while damage from cigarette smoking is well documented, LLNL researchers are now looking at prenatal damage that may occur.

Better Ways to Detect, Treat Cancer

We are developing several breakthrough tools for cancer detection and treatment. Our expertise in materials imaging is paying off in a better way to detect breast cancer. We've developed a digital breast-screening device that requires less x-ray dose yet shows more detail than traditional techniques.

Our Smart Probe uses a small needle to determine whether a breast lump is malignant. And we're developing a fiber-optic technique for imaging tissues deep beneath the skin to dramatically improve the ability to detect cancer.



An LLNL researcher studies chromosome damage from second-hand smoke in newborn babies

Joining with UC Davis

In 2000 we joined forces with the University of California at Davis Cancer Center to fight cancer. Together, we are researching cancer biology, prevention, and control as well as new cancer detection and treatment techniques.

Livermore brings to the venture its multidisciplinary teams of scientists and engineers, supercomputing expertise, and a biomedical research program that dates back to the early 1960s. The UC Davis Cancer Center contributes its patient-centered research and clinical experience. The collaboration offers a clinical testing ground for medical technologies that LLNL develops.

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Bioscience and Health Research at Lawrence Livermore National Laboratory

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